What is claimed is:

1. A method of determining an event on a wire comprising:

receiving a signal on the wire;

performing compensation processing of said signal producing a compensated signal;

performing event identification processing of said compensated signal to identify at least one event; and

classifying said at least one event.

2. The method of Claim 1, further comprising:

compensating said signal to remove unwanted reflective components due to inverse scattering producing a first adjusted signal; and

performing attenuation compensation on said first adjusted signal.

3. The method of Claim 2, wherein said attenuation compensation is a function of frequency and an amount of time said signal has traveled in said wire.

4. The method of Claim 2, wherein said attenuation compensation is a function of frequency.

5. The method of Claim 2, further comprising:

associating event data with at least one predetermined event prior to said classifying, wherein said classifying uses said event data.

6. The method of Claim 5, wherein said at least one predetermined event includes at least one of: a connector, a cut, a nick, a crimp, damage to wire insulation due to age, damage to wire insulation due to coupling of the wire with another element.

7. The method of Claim 6, further comprising:

determining said event data by empirical analysis.

8. The method of Claim 6, further comprising:

determining said event data using a model.

9. The method of Claim 6, further comprising:

storing said event data in a library.

10. The method of Claim 1, further comprising:

determining a first derivative of said signal; and

identifying at least one peak of said first derivative exceeding a predetermined threshold as an event.

11. The method of Claim 1, further comprising:

determining a plurality of polynomials, each of said polynomials locally fitted to a portion of data points defining a portion of said signal, each of said portion of data points being including a kernel point;

determining a plurality of first derivatives of said first polynomials;

evaluating each of said plurality of first derivatives at a corresponding kernel point producing a plurality of evaluated first derivatives; and

determining said at least one event using said plurality of evaluated first derivatives.

12. The method of Claim 1, wherein said signal is a reflective signal and the method further comprising:

analyzing said reflective signal in accordance with at least one joint time-frequency domain reflectometry technique.

13. The method of Claim 12, further comprising:

sending a signal on the wire wherein said signal is one of: an impulse signal and a predetermined wavelet.

14. The method of Claim 13, further comprising:

determining at least one characteristic of said reflective signal in accordance with a predetermined wavelet; and

using said at least one characteristic in said event identification and said classifying.

15. A device that determines an event on a wire comprising:

a receiver that receives a signal on the wire; and

a processor that performs compensation processing of the signal producing a compensated signal, performs event identification processing of the compensated signal to identify at least one event, and that classifies said at least one event.

16. The device of Claim 15, wherein said processor compensates said signal to remove unwanted reflective components due to inverse scattering producing a first adjusted signal and performs attenuation compensation on said first adjusted signal.

17. The device of Claim 16, wherein said attenuation compensation is a function of frequency and an amount of time said signal has traveled in said wire.

18. The device of Claim 16, wherein said attenuation compensation is a function of frequency.

19. The device of Claim 16, further comprising:

a data storage element containing event data, wherein said processor associates said event data with at least one predetermined event prior to said classifying, wherein said classifying uses said event data.

20. The device of Claim 19, wherein said at least one predetermined event includes at least one of: a connector, a cut, a nick, a crimp, damage to wire insulation due to age, damage to wire insulation due to coupling of the wire with another element.

21. The device of Claim 20, wherein said processor determines said event data by empirical analysis.

22. The device of Claim 20, wherein said processor determines said event data using a model.

23. The device of Claim 15, wherein said processor determines a first derivative of said signal and identifies at least one peak of said first derivative exceeding a predetermined threshold as an event.

24. The device of Claim 15, wherein said processor determines a plurality of polynomials, each of said polynomials locally fitted to a portion of data points defining a portion of said signal, each of said portion of data points being including a kernel point, said processor determines a plurality of first derivatives of said first polynomials, said

processor evaluates each of said plurality of first derivatives at a corresponding kernel point producing a plurality of evaluated first derivatives, and said processor determines said at least one event using said plurality of evaluated first derivatives.

25. The device of Claim 15, wherein said signal is a reflective signal and said processor analyzes said reflective signal in accordance with at least one joint time-frequency domain reflectometry technique.

26. The device of claim 25, further comprising:

a signal generator that generates at least one of: an impulse signal and a predetermined wavelet.

27. The device of Claim 26, wherein the processor determines at least one characteristic of said reflective signal in accordance with a predetermined wavelet and wherein said at least one characteristic is used in said event identification and said classifying.

28. A computer program product that determines an event on a wire, comprising:

executable code that receives a signal on the wire;

executable code that performs compensation processing of the signal producing a compensated signal;

executable code that performs event identification processing of the compensated signal to identify at least one event; and

executable code that classifies said at least one event.

29. The computer program product of Claim 28, further comprising:

executable code that compensates said signal to remove unwanted reflective components due to inverse scattering producing a first adjusted signal; and

executable code that performs attenuation compensation on said first adjusted signal.

30. The computer program product of Claim 29, wherein said attenuation compensation is a function of frequency and an amount of time said signal has traveled in said wire.

31. The computer program product of Claim 29, wherein said attenuation compensation is a function of frequency.

32. The computer program product of Claim 29, further comprising:

executable code that associates event data with at least one predetermined event prior to classifying, wherein classifying uses said event data.

33. The computer program product of Claim 32, wherein said at least one predetermined event includes at least one of: a connector, a cut, a nick, a crimp, damage to wire insulation due to age, damage to wire insulation due to coupling of the wire with another element.

34. The computer program product of Claim 33, further comprising:

executable code that determines said event data by empirical analysis.

35. The computer program product of Claim 33, further comprising:

executable code that determines said event data using a model.

36. The computer program product of Claim 33, further comprising:

executable code stores said event data in a library.

37. The computer program product of Claim 29, further comprising:

executable code that determines a first derivative of said signal; and

executable code that identifies at least one peak of said first derivative exceeding a predetermined threshold as an event.

38. The computer program product of Claim 28, further comprising:

executable code that determines a plurality of polynomials, each of said polynomials locally fitted to a portion of data points defining a portion of said signal, each of said portion of data points being including a kernel point;

executable code that determines a plurality of first derivatives of said first polynomials;

executable code that evaluates each of said plurality of first derivatives at a corresponding kernel point producing a plurality of evaluated first derivatives; and

executable code that determines said at least one event using said plurality of evaluated first derivatives.

39. The computer program product of Claim 28, wherein said signal is a reflective signal and computer program product is further comprising:

executable code that analyzes said reflective signal in accordance with at least one joint time-frequency domain reflectometry technique.

40. The computer program product of Claim 39, further comprising:

executable code that sends a signal on the wire wherein said signal is one of: an impulse signal and a predetermined wavelet.

41. The computer program product of Claim 13, further comprising:

executable code that determines at least one characteristic of said reflective signal in accordance with a predetermined wavelet; and

executable code that uses said at least one characteristic in said event identification and said classifying.

42. A method for identifying an event of interest in a cable, comprising:

receiving a voltage waveform signal;

taking a first derivative of said voltage waveform signal with respect to time;

calculating a standard deviation of a first derivative of system noise;

establishing an event detection threshold corresponding to said standard deviation of said first derivative of system noise; and

identifying a portion of said voltage waveform signal having a differential voltage peak with an absolute value that exceeds said event detection threshold.

43. The method of Claim 42, further comprising:

converting said portion of said voltage waveform signal to a reflection waveform pattern.

44. The method of Claim 42, wherein said system noise follows a Gaussian distribution.

45. The method of Claim 42, further comprising:

storing said portion of said voltage waveform signal.

46. The method of Claim 42, further comprising:

establishing a new event detection threshold.

47. The method of Claim 42, wherein said voltage waveform signal received has been corrected for attenuation loss.

48. The method of Claim 42, wherein said voltage waveform signal received has been corrected to remove inverse scattering reflections.

49. A device that identifies an event of interest in a cable, comprising:

a receiver that receives a voltage waveform signal; and

a processor that processes said voltage waveform signal, establishes an event detection threshold corresponding to a standard deviation of a first derivative of system noise, and identifies a portion of said voltage waveform signal having a differential voltage peak with an absolute value exceeding said event detection threshold.

50. The device of Claim 49, wherein said processor converts said portion of said voltage waveform signal into a reflection waveform pattern.

51. The device of Claim 49, further comprising:

a storage component that stores said portion of said voltage waveform signal.

52. A computer program product that identifies an event of interest in a cable, comprising:

executable code that receives a voltage waveform signal;

executable code that takes a first derivative of said voltage waveform signal with respect to time;

executable code that calculates a standard deviation of a first derivative of system noise;

executable code that establishes an event detection threshold corresponding to said standard deviation of said first derivative of system noise; and

executable code that identifies a portion of said voltage waveform signal having a differential voltage peak with an absolute value that exceeds said event detection threshold.

53. The computer program product of Claim 52, further comprising:

executable code that converts said portion of said voltage waveform signal to a reflection waveform pattern.

54. The computer program product of Claim 52, wherein said system noise follows a Gaussian distribution.

55. The computer program product of Claim 52, further comprising:

executable code that stores said portion of said voltage waveform signal.

56. The computer program product of Claim 52, further comprising:

executable code that establishes a new event detection threshold.

57. The computer program product of Claim 52, wherein said voltage waveform signal is corrected for attenuation loss.

58. The computer program product of claim 52, wherein said voltage waveform signal is corrected to remove inverse scattering reflections.

59. A method for creating a classification library for cable analysis, comprising:

generating a reflection waveform pattern of an event;

processing said reflection waveform pattern to produce a classification reflection waveform pattern;

storing said classification reflection waveform pattern.

60. The method of Claim 59, wherein said event is selected from the group consisting of: a fault, a connector, and a termination.

61. The method of Claim 59, wherein generating a reflection waveform pattern includes:

creating a specified type of fault in a cable of a specified type;

producing a voltage waveform signal in said cable;

identifying a reflected voltage waveform signal portion for said specified type of fault; and

converting said reflected voltage waveform signal portion into a reflection waveform pattern.

62. The method of Claim 59, wherein generating a reflection waveform pattern includes:

simulating said event utilizing an analytical model; and

generating a reflection waveform pattern from said analytical model.

63. The method of Claim 59, wherein processing said reflection waveform pattern includes normalizing and correcting said reflection waveform pattern to produce said classification reflection waveform pattern.

64. The method of Claim 61, further comprising:

providing a plurality of voltage waveform signals;

calculating a mean value reflection waveform pattern from at least two normalized and corrected reflection waveform patterns;

calculating a variance array that includes variance information of said least two normalized reflection waveform patterns compared with said mean value reflection waveform pattern; and

storing said variance array so as to be accessible with said classification reflection waveform pattern.

65. The method of Claim 64, further comprising:

generating a covariance matrix using information in said variance array;

storing said covariance matrix so as to be accessible with said classification reflection waveform pattern.

66. The method of Claim 62, further comprising:

adjusting component values of said analytical model prior to resimulating said event utilizing an analytical model and regenerating a reflection waveform pattern from said analytical model;

generating a variance array corresponding to the adjustment of said component values in said analytical model;

storing said variance array so as to be accessible with said classification reflection waveform pattern.

67. A computer program product that creates a classification library for cable analysis, comprising:

executable code that generates a reflection waveform pattern of an event;

executable code that processes said reflection waveform pattern to produce a classification reflection waveform pattern; and

executable code that stores said classification reflection waveform pattern.

68. The computer program product of Claim 67, wherein said event is selected from the group consisting of: a fault, a connector, and a termination.

69. The computer program product of Claim 67, wherein said executable code that generates a reflection waveform pattern of an event, includes:

executable code that produces a voltage waveform signal in said cable;

executable code that identifies a reflected voltage waveform signal portion for a specified type of fault;

executable code that converts said reflected voltage waveform signal portion into a reflection waveform pattern.

70. The computer program product of Claim 67, wherein said executable code that generates a reflection waveform pattern of an event, includes:

executable code that simulates said event utilizing an analytical model; and

executable code that generates a reflection waveform pattern from said analytical model.

71. The computer program product of Claim 67, wherein said executable code that processes said reflection waveform pattern to produce a classification reflection waveform pattern includes executable code that normalizes and corrects said reflection waveform pattern to produce said classification reflection waveform pattern.

72. The computer program product of claim 69, further comprising:

executable code that calculates a mean value reflection waveform pattern from at least two normalized and corrected reflection waveform patterns;

executable code that calculates a variance array that includes variance information of said least two normalized reflection waveform patterns compared with said mean value reflection waveform pattern; and

executable code that stores said variance array so as to be accessible with said classification reflection waveform pattern.

73. The computer program product of Claim 72, further comprising:

executable code that generates a covariance matrix using information in said variance array; and

executable code that stores said covariance matrix so as to be accessible with said classification reflection waveform pattern.

74. The computer program product of Claim 70, further comprising:

executable code that adjusts component values of said analytical model;

executable code that generates a variance array corresponding to the adjustment of said component values in said analytical model; and

executable code that stores said variance array so as to be accessible with said classification reflection waveform pattern.

75. A method of compensating an electrical signal, comprising:

digitizing the electrical signal to provide a digitized signal;

determining attenuation as a function of signal frequency;

constructing a digital filter that approximates an inverse of the attenuation; and

applying the digital filter to the digitized signal.

76. The method of Claim 74, wherein determining attenuation as a function of frequency includes using the equation:

$$A(f, L) = e^{-(R(f) * L/Z0)}$$

where Z0 is the characteristic impedance of a conductor on which the electrical signal propagates, L is the length of the conductor, and R(f) is the frequency dependent resistance of the conductor.

77. The method of Claim 76, wherein R(f) is proportional to the square root of the frequency.

78. The method of Claim 77, where R(f) is determined using the equation:

$$R(f) = (1/2r) * (\mu f/\pi\sigma)^{1/2}$$

where r is the radius of the conductor, μ is the permeability of free space in henries per meter, and σ is the conductivity of material of the conductor.

79. The method of Claim 78, wherein σ is 5.8×10^7 ohms/meter.

80. The method of Claim 76, further comprising:

determining length of the conductor.

81. The method of Claim 80, wherein determining the length of the conductor includes:

taking a derivative of the digitized signal;

determining if the conductor terminates in one of: an open and a short;

if the conductor terminates in an open, finding the maximum value for the derivative and calculating the length based thereon; and

if the conductor terminates in a short, finding a minimum value for the derivative and calculating the length based thereon.

82. The method of Claim 81, further comprising:

determining a median voltage between a first one of the digitized signals and a digitized signal corresponding to the length of the conductor.

83. The method of Claim 82, further comprising:

determining the impedance of the conductor based on the median voltage.

84. The method of Claim 75, wherein the attenuation is also a function of a length traveled by each portion of the signal and varies as a function of time.

85. The method of Claim 84, wherein determining attenuation as a function of frequency includes using the equation:

$$A(f, L) = e^{-(R(f) * L/Z0)}$$

where Z0 is the characteristic impedance of a conductor on which the electrical signal propagates, L is proportional to a time of sampling of the digitized signal, and R(f) is the frequency dependent resistance of the conductor.

86. The method of Claim 85, wherein coefficients of the digital filter vary according to the time of sampling of the digitized signal.

87. The method of Claim 86, further comprising:

determining length of the conductor.

88. The method of Claim 87, wherein determining the length of the conductor includes:

taking a derivative of the digitized signal;

determining if the conductor terminates in one of: an open and a short;

if the conductor terminates in an open, finding the maximum value for the derivative and calculating the length based thereon; and

if the conductor terminates in a short, finding a minimum value for the derivative and calculating the length based thereon.

89. The method of Claim 88, further comprising:

determining a median voltage between a first one of the digitized signals and a digitized signal corresponding to the length of the conductor.

90. The method of Claim 89, further comprising:

determining the impedance of the conductor based on the median voltage.

91. The method of Claim 75, wherein the digital filter is an FIR filter.

92. A computer program product that compensates an electrical signal, comprising:

executable code that digitizes the electrical signal to provide a digitized signal;

executable code that determines attenuation as a function of signal frequency;

constructing a digital filter that approximates an inverse of the attenuation; and

applying the digital filter to the digitized signal.

93. The computer program product of Claim 92, wherein executable code that determines attenuation as a function of frequency uses the equation:

$$A(f, L) = e^{-(R(f) * L/Z0)}$$

where Z0 is the characteristic impedance of a conductor on which the electrical signal propagates, L is the length of the conductor, and R(f) is the frequency dependent resistance of the conductor.

94. The computer program product of Claim 93, wherein R(f) is proportional to the square root of the frequency.

95. The computer program product of Claim 94, where R(f) is determined using the equation:

$$R(f) = (1/2r) * (\mu f/\pi\sigma)^{1/2}$$

where r is the radius of the conductor, μ is the permeability of free space in henries per meter, and σ is the conductivity of material of the conductor.

96. The computer program product of Claim 95, wherein σ is 5.8×10^7 ohms/meter.

97. The computer program product of Claim 93, further comprising:

executable code that determines length of the conductor.

98. The computer program product of Claim 97, wherein executable code that determines the length of the conductor includes:

executable code that takes a derivative of the digitized signal;

executable code that determines if the conductor terminates in one of: an open and a short;

executable code that finds the maximum value for the derivative and calculates the length based thereon if the conductor terminates in an open; and

executable code that finds a minimum value for the derivative and calculates the length based thereon if the conductor terminates in a short.

99. The computer program product of Claim 98, further comprising:

executable code that determines a median voltage between a first one of the digitized signals and a digitized signal corresponding to the length of the conductor.

100. The computer program product of Claim 99, further comprising:

executable code that determines the impedance of the conductor based on the median voltage.

101. The computer program product of Claim 92, wherein the attenuation is also a function of a length traveled by each portion of the signal and varies as a function of time.

102. The computer program product of Claim 101, wherein executable code that determines attenuation as a function of frequency uses the equation:

$$A(f, L) = e^{-(R(f) * L/Z0)}$$

where Z0 is the characteristic impedance of a conductor on which the electrical signal propagates, L is proportional to a time of sampling of the digitized signal, and R(f) is the frequency dependent resistance of the conductor.

103. The computer program product of Claim 102, wherein coefficients of the digital filter vary according to the time of sampling of the digitized signal.

104. The computer program product of Claim 103, further comprising:

executable code that determines length of the conductor.

105. The computer program product of Claim 104, wherein executable code that determines the length of the conductor includes:

executable code that takes a derivative of the digitized signal;

executable code that determines if the conductor terminates in one of: an open and a short;

executable code that finds the maximum value for the derivative and calculates the length based thereon if the conductor terminates in an open; and

executable code that finds a minimum value for the derivative and calculates the length based thereon if the conductor terminates in a short.

106. The computer program product of Claim 105, further comprising:

executable code that determines a median voltage between a first one of the digitized signals and a digitized signal corresponding to the length of the conductor.

107. The computer program product of Claim 106, further comprising:

executable code that determines the impedance of the conductor based on the median voltage.

108. The computer program product of Claim 102, wherein the digital filter is an FIR filter.

109. A method of classifying a portion of an electrical signal propagating through a conductor, comprising:

digitizing the electrical signal to provide a digitized signal;

providing a plurality of stored digitized signals, wherein each stored digitized signal corresponds to a type of fault for the conductor;

determining a plurality of scores by comparing the digitized signal with each of the plurality of stored signals;

selecting a highest one of the scores;

classifying the portion of the signal according to a type of fault corresponding to the highest one of the scores if the highest one of the scores is greater than a predetermined value; and

classifying the portion of the electrical signal as noise if the highest one of the scores is not greater than the predetermined value.

110. The method of Claim 109, further comprising:

converting the digitized signal to reflection coefficients.

111. The method of Claim 109, wherein the reflection coefficients correspond to values of the digitized signal divided by an input signal magnitude.

112. The method of Claim 109, wherein determining a plurality of scores includes:

obtaining variance values for each of the stored digitized signals;

obtaining a stored digitized signal corresponding to noise; and

calculating each of the scores using the digitized signal, the variance values, the stored digitized signal corresponding to noise, and each of the stored digitized signals corresponding to each type of fault.

113. The method of Claim 109, wherein determining a plurality of scores includes:

obtaining variance values for each of the stored digitized signals;

obtaining covariance values for each of the stored digitized signals;

obtaining a stored digitized signal corresponding to noise; and

calculating each of the scores using the digitized signal, the variance values, the covariance values, the stored digitized signal corresponding to noise, and each of the stored digitized signals corresponding to each type of fault.

114. The method of Claim 113, wherein the variance and covariance values are provided in a matrix.

115. A computer program product that classifies a portion of an electrical signal propagating through a conductor, comprising:

executable code that digitizes the electrical signal to provide a digitized signal;

executable code that provides a plurality of stored digitized signals, wherein each stored digitized signal corresponds to a type of fault for the conductor;

executable code that determines a plurality of scores by comparing the digitized signal with each of the plurality of stored signals;

executable code that selects a highest one of the scores;

executable code that classifies the portion of the signal according to a type of fault corresponding to the highest one of the scores if the highest one of the scores is greater than a predetermined value; and

executable code that classifies the portion of the electrical signal as noise if the highest one of the scores is not greater than the predetermined value.

116. The computer program product of Claim 115, further comprising:

executable code that converts the digitized signal to reflection coefficients.

117. The computer program product of Claim 115, wherein the reflection coefficients correspond to values of the digitized signal divided by an input signal magnitude.

118. The computer program product of Claim 115, wherein executable code that determines a plurality of scores includes:

executable code that obtains variance values for each of the stored digitized signals;

executable code that obtains a stored digitized signal corresponding to noise; and

executable code that calculates each of the scores using the digitized signal, the variance values, the stored digitized signal corresponding to noise, and each of the stored digitized signals corresponding to each type of fault.

119. The computer program product of Claim 115, wherein executable code that determines a plurality of scores includes:

executable code that obtains variance values for each of the stored digitized signals;

executable code that obtains covariance values for each of the stored digitized signals;

executable code that obtains a stored digitized signal corresponding to noise; and

executable code that calculates each of the scores using the digitized signal, the variance values, the covariance values, the stored digitized signal corresponding to noise, and each of the stored digitized signals corresponding to each type of fault.

120. The computer program product of Claim 119, wherein the variance and covariance values are provided in a matrix.

121. A method for detecting an event on a wire comprising:

determining a plurality of polynomials, each of said polynomials fitting a portion of data points representing a received waveform;

determining a first derivative for each of said plurality of polynomials;

evaluating said first derivative of each of said plurality of polynomials at data points representing said received waveform; and

detecting an event using said first derivative of each of said plurality of polynomials.

122. The method of Claim 121, further comprising:

compensating said received waveform prior to said determining a plurality of polynomials.

123. The method of Claim 121, wherein the event is one of: a connector, a cut, a nick, a crimp, damage to wire insulation due to age, damage to wire insulation due to coupling of the wire with another element.

124. The method of Claim 121, further comprising:

storing data of said waveform in accordance with said event detected.

125. The method of Claim 121, further comprising:

classifying said event.

126. The method of Claim 121, wherein said portion of data points has N+M+1 data points, N representing a number of data points prior to a first one of said data points included in said portion, M representing a number of data points prior to said first one of said data points included in said portion, and the method further comprising:

determining a first of said plurality of polynomials in accordance with said N+M+1 data points.

127. The method of Claim 126, further comprising:

determining a first derivative of said first polynomial; and

evaluating said first derivative at said first one of said data points included in said portion.

128. The method of Claim 121, further comprising:

determining an event detection threshold.

129. The method of Claim 128, further comprising:

determining at least one peak using said first derivatives that exceeds said event detection threshold;

storing data corresponding to said at least one peak; and

classifying said data as one of a plurality of events.

130. A computer program product for detecting an event on a wire comprising:

executable code that determines a plurality of polynomials, each of said polynomials fitting a portion of data points representing a received waveform;

executable code that determines a first derivative for each of said plurality of polynomials;

executable code that evaluates said first derivative of each of said plurality of polynomials at data points representing said received waveform; and

executable code that detects an event using said first derivative of each of said plurality of polynomials.

131. The computer program product of Claim 130, further comprising:

executable code that compensates said received waveform prior to said determining a plurality of polynomials.

132. The computer program product of Claim 130, wherein the event is one of: a connector, a cut, a nick, a crimp, damage to wire insulation due to age, damage to wire insulation due to coupling of the wire with another element.

133. The computer program product of Claim 130, further comprising:

executable code that stores data of said waveform in accordance with said event detected.

134. The computer program product of Claim 130, further comprising:

executable code that classifies said event.

135. The computer program product of Claim 130, wherein said portion of data points has N+M+1 data points, N representing a number of data points prior to a first one of said data points included in said portion, M representing a number of data points prior to said first one of said data points included in said portion, and the computer program product further comprising:

executable code that determines a first of said plurality of polynomials in accordance with said N+M+1 data points.

136. The computer program product of Claim 135, further comprising:

executable code that determines a first derivative of said first polynomial; and

executable code that evaluates said first derivative at said first one of said data points included in said portion.

137. The computer program product of Claim 130, further comprising:

executable code that determines an event detection threshold.

138. The computer program product of Claim 137, further comprising:

executable code that determines at least one peak using said first derivatives evaluated that exceed said event detection threshold;

executable code that stores data corresponding to said at least one peak; and

executable code that classifies said data as one of a plurality of events.

139. A method of processing a signal received on a wire comprising:

receiving said signal;

compensating said signal to remove unwanted reflections caused by a defect in said wire producing a compensated signal; and

analyzing said compensated signal to determine information about said defect.

140. The method of Claim 139, further comprising:

receiving a plurality of reflective voltages and a plurality of incident voltages, wherein at a measured voltage at a time is equal to a sum of a reflective voltage and an incident voltage at a the time;

adjusting each of said plurality of reflective voltages and said plurality of incident voltages determined at a point to remove unwanted reflections from the point to the end of the wire.

141. The method of Claim 140, wherein there are N incident voltages and N corresponding reflective voltages, and the method further comprising:

initializing a first row of an NxN matrix, D, with said N incident voltages;

initializing a first row of an NxN matrix, U, with said N reflective voltages;

determining reflection coefficients corresponding to said N incident and N reflective voltages;

determining transmission coefficients corresponding to said reflection coefficients;

for each element of row ii of matrix D, ii = 2 to N, determining D(ii,jj) = (D(i,j) – r(ii) * U(i, jj))/s(ii), where i = 1 to N-1 ,j = i to N-1, jj = j+1, s(ii) is a transmission coefficient at time ii, r(ii) is a reflection coefficient at a time ii; and

for each element of row ii of matrix U, determining U(ii,jj) = (-r(ii)*D(i,j) + U(i,jj))/s(ii), wherein diagonals of matrix D, D[t,t], t=1 to N, are N adjusted incident voltages at each time t, Vinc,adj(t).

142. The method of Claim 141, further comprising:

determining adjusted reflective voltages at each time t, Vrefl,adj(t), as:

Vrefl,adj(t) = (Z(t+1) – Z_0) / (Z_0 + Z(t+1)) * Vinc,adj(t) + Vinc,adj(t),

where Z_0 is a characteristic impedance of the wire, Z(t+1)=Z(t) *(1+r(t)) / (1-r(t)).

143. The method of Claim 142, further comprising:

performing error correction by assigning each of said reflection coefficients to zero if said each reflection coefficient is less than a predetermined threshold.

144. The method of Claim 143, wherein said predetermined threshold is a value equal to a product of three times a standard deviation of a noise level.

145. A computer program product that processes a signal received on a wire comprising:

executable code that receives said signal;

executable code that compensates said signal to remove unwanted reflections caused by a defect in said wire producing a compensated signal; and

executable code that analyzes said compensated signal to determine information about said defect.

146. The computer program product of Claim 145, further comprising:

executable code that receives a plurality of reflective voltages and a plurality of incident voltages, wherein at a measured voltage at a time is equal to a sum of a reflective voltage and an incident voltage at a the time;

executable code that adjusts each of said plurality of reflective voltages and said plurality of incident voltages determined at a point to remove unwanted reflections from the point to the end of the wire.

147. The computer program product of Claim 146, wherein there are N incident voltages and N corresponding reflective voltages, and the computer program product further comprising:

executable code that initializes a first row of an NxN matrix, D, with said N incident voltages;

executable code that initializes a first row of an NxN matrix, U, with said N reflective voltages;

executable code that determines reflection coefficients corresponding to said N incident and N reflective voltages;

executable code that determines transmission coefficients corresponding to said reflection coefficients;

executable code that, for each element of row ii of matrix D, ii = 2 to N, determines D(ii,jj) = (D(i,j) – r(ii) * U(i, jj))/s(ii), where i = 1 to N-1 ,j = i to N-1, jj = j+1, s(ii) is a transmission coefficient at time ii, r(ii) is a reflection coefficient at a time ii; and

executable code that, for each element of row ii of matrix U, determines U(ii,jj) = (-r(ii)*D(i,j) + U(i,jj))/s(ii), wherein diagonals of matrix D, D[t,t], t=1 to N, are N adjusted incident voltages at each time t, Vinc,adj(t).

148. The computer program product of Claim 147, further comprising:

executable code that determines adjusted reflective voltages at each time t, Vrefl,adj(t), as:

$$\text{Vrefl,adj}(t) = (Z(t+1) - Z_0) / (Z_0 + Z(t+1)) * \text{Vinc,adj}(t) + \text{Vinc,adj}(t),$$

where Z_0 is a characteristic impedance of the wire, $Z(t+1)=Z(t) *(1+r(t)) / (1-r(t))$.

149. The computer program product of Claim 148, further comprising:

executable code that performs error correction by assigning each of said reflection coefficients to zero if said each reflection coefficient is less than a predetermined threshold.

150. The computer program product of Claim 149, wherein said predetermined threshold is a value equal to a product of three times a standard deviation of a noise level.

151. A method of detecting events on a wire comprising:

determining at least one set of reference data indicating a wire event;

sending an impulse signal on the wire;

obtaining a reflective return signal corresponding to said impulse signal; and

analyzing said reflective signal in accordance with at least one joint time-frequency domain reflectometry technique.

152. The method of Claim 151, wherein said impulse signal is generated in accordance with a predetermined wavelet.

153. The method of Claim 151, further comprising:

determining at least one characteristic of said reflective signal in accordance with a predetermined wavelet.

154. The method of Claim 153, further comprising:

performing wavelet analysis using a continuous wavelet transform.

155. The method of Claim 154, further comprising:

determining ρ as a feature of said reflective signal wherein ρ is a differential wavelet energy ratio ρ proportional to the deviation of a signature energy with respect to a baseline of a said wire in a healthy condition for a given time-frequency span.

156. The method of Claim 155, wherein increasing values of ρ, are associated with increasing severity of wire events detected.

157. The method of Claim 155, wherein ρ is represented as:

$$\rho = \sqrt{\frac{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|C_{sk} - C_{sk}^{\text{Baseline}}\right|^2}{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|C_{sk}^{\text{Baseline}}\right|^2}}$$

in which:

C_{sk} represents continuous wavelet coefficients of a signal under test collected over a time-span of N samples and a time-scale span of S scales, wherein said scales are parameters used in performing said wavelet analysis; and

C_{sk}^{Baseline} represents a set of wavelet coefficients of a baseline signal associated with a healthy signature.

158. The method of Claim 157, further comprising:

determining δ as a feature of said reflective signal, wherein δ is a local wavelet energy ratio of a signature of interest with respect to a baseline of a healthy signature, said local nature of said signatures relating to a partial derivative of signal energy with respect to a time-scale corresponding to an inverse frequency of said signal energy.

159. The method of Claim 158, wherein δ is represented as:

$$\delta = \sqrt{\frac{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|\frac{\partial C_{sk}}{\partial s} - \frac{\partial C_{sk}^{Baseline}}{\partial s}\right|^2}{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|\frac{\partial C_{sk}^{Baseline}}{\partial s}\right|^2}}$$

in which ∂ represents a partial derivative.

160. The method of Claim 151, further comprising: decomposing said reflective signal.

161. The method of Claim 160,wherein said reflective signal is decomposed into at least one intrinsic mode function.

162. The method of Claim 161, further comprising:

applying a Hilbert transform to each of said at least one intrinsic mode function.

163. A method of detecting events on a wire comprising:

determining at least one set of reference data indicating a wire event;

sending an impulse signal on the wire;

obtaining a reflective return signal corresponding to said impulse signal; and

analyzing said reflective signal producing at least one joint time-frequency parameter.

164. The method of Claim 163, further comprising:

determining an occurrence of a wire event by comparing values of said at least one joint time-frequency parameter of the wire to known parameter values associated with the wire event.

165. The method of Claim 163, further comprising:

performing at least one of: a wavelet analysis and a Hilbert-Huang transform when analyzing the reflective signal.

166. A computer program product for detecting events on a wire comprising:

executable code that determines at least one set of reference data indicating a wire event;

executable code that sends an impulse signal on the wire;

executable code that obtains a reflective return signal corresponding to said impulse signal; and

executable code that analyzes said reflective signal in accordance with at least one joint time-frequency domain reflectometry technique.

167. The computer program product of Claim 166, wherein said impulse signal is generated in accordance with a predetermined wavelet.

168. The computer program product of Claim 166, further comprising:

executable code that determines at least one characteristic of said reflective signal in accordance with a predetermined wavelet.

169. The computer program product of Claim 168, further comprising:

executable code that performs wavelet analysis using a continuous wavelet transform.

170. The computer program product of Claim 169, further comprising:

executable code that determines ρ as a feature of said reflective signal wherein ρ is a differential wavelet energy ratio ρ proportional to the deviation of a signature energy with respect to a baseline of a said wire in a healthy condition for a given time-frequency span.

171. The computer program product of Claim 170, wherein increasing values of ρ, are associated with increasing severity of wire events detected.

172. The computer program product of Claim 170, wherein ρ is represented as:

$$\rho = \sqrt{\frac{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|C_{sk} - C_{sk}^{\text{Baseline}}\right|^2}{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|C_{sk}^{\text{Baseline}}\right|^2}}$$

in which:

C_{sk} represents continuous wavelet coefficients of a signal under test collected over a time-span of N samples and a time-scale span of S scales, wherein said scales are parameters used in performing said wavelet analysis; and

C_{sk}^{Baseline} represents a set of wavelet coefficients of a baseline signal associated with a healthy signature.

173. The computer program product of Claim 172, further comprising:

executable code that determines δ as a feature of said reflective signal, wherein δ is a local wavelet energy ratio of a signature of interest with respect to a baseline of a healthy signature, said local nature of said signatures relating to a partial derivative of signal energy with respect to a time-scale corresponding to an inverse frequency of said signal energy.

174. The computer program product of Claim 173, wherein δ is represented as:

$$\delta = \sqrt{\frac{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|\frac{\partial C_{sk}}{\partial s} - \frac{\partial C_{sk}^{Baseline}}{\partial s}\right|^2}{\sum_{k=1}^{N}\sum_{s=1}^{S}\left|\frac{\partial C_{sk}^{Baseline}}{\partial s}\right|^2}}$$

in which ∂ represents a partial derivative.

175. The computer program product of Claim 166, further comprising:

machine executable code that decomposes said reflective signal.

176. The computer program product of Claim 175,wherein said reflective signal is decomposed into at least one intrinsic mode function.

177. The computer program product of Claim 176, further comprising:

machine executable code that applies a Hilbert transform to each of said at least one intrinsic mode function.

178. A computer program product for detecting events on a wire comprising:

executable code that determines at least one set of reference data indicating a wire event;

executable code that sends an impulse signal on the wire;

executable code that obtains a reflective return signal corresponding to said impulse signal; and

executable code that analyzes said reflective signal producing at least one joint time-frequency parameter.

179. The computer program product of Claim 178, further comprising:

executable code that determines an occurrence of a wire event by comparing values of said at least one joint time-frequency parameter of the wire to known parameter values associated with the wire event.

180. The computer program product of Claim 178, further comprising:

machine executable code that performs at least one of: a wavelet analysis and a Hilbert-Huang transform when analyzing the reflective signal.